RESORT NO. 2 - PRELIMINARY SOIL REPORT

MAUNALUA, OAHU, HAWAII
TAX MAP KEY: 3-9-11

To:
KAISER-AETNA

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

September 29, 1970

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

WALTER LUM
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September 29, 1970

KAISER-AETNA
P. O. Box 2997
Honolulu, Hawaii 96802

Gentlemen:

Subject: Resort No. 2
Preliminary Soil Report
(for site grading design purposes)
Maunalua, Oahu, Hawaii
Tax Map Key: 3-9-11
Chapter 23, Revised Ordinances of Honolulu,
1961 As Amended

The Resort Division area consists of resort, apartment and residential subdivisions.

In accordance with your request, preliminary soil explorations were made to cover the general area. This report concerns only the preliminary soil explorations at the site for the proposed Resort No. 2, Maunalua, Oahu, Hawaii.

The borings generally indicated surface layers of silty or clayey sand and coral underlain by lava rock. However, localized areas of clay (adobe) and muck were encountered. Rock outcrops were noted adjacent to the highway and Wawamalu Stream, and generally along the shoreline.

Some grading and filling of the site are contemplated. The earthwork should be done in accordance with the requirements of Chapter 23, Revised Ordinances of Honolulu, 1961 As Amended and the recommendations contained herein.

Light apartment structures may be constructed with ordinary footings or foundations.

Because lava rock may be encountered relatively close to the surface, high-rise buildings may be constructed with relatively simple foundations. The depth of the rock formation was not determined for this report. More explorations should be made for the design of a specific structure and location.

The report includes a Boring Location Plan, boring logs, laboratory test results, recommendations and limitations.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

Ezra Koike

Ezra Koike
Professional Engineer
Hawaii No. 1450

EK:vl

C O N T E N T S

RESORT NO. 2 - PRELIMINARY SOIL REPORT

MAUNALUA, OAHU, HAWAII
TAX MAY KEY: 3-9-11

SCOPE OF EXPLORATION

The Resort Division area consists of resort, apartment and residential subdivisions. This report concerns only the preliminary soil explorations at the site for the proposed Resort No. 2 at Maunalua, Oahu, Hawaii. The limits of this area are shown on Figure 1. The purpose of this exploration was to determine general soil conditions for site grading design purposes.

This report includes field exploration, laboratory tests and general recommendations for site grading and light building foundation design.

FIELD EXPLORATION

Fourteen borings were made at the site. The locations of these borings are shown on Figure 1, Boring Location Plan.

The borings were made with 3 and 4-in. diameter augers using tungsten carbide bits. Soil samples were recovered with a standard split spoon driven with a 140-lb hammer falling 30 inches.

Soft spots were probed by pushing a re-bar into the muck. Soil samples were recovered with a hand auger.

Soil samples were visually observed and subjected to appropriate tests in the laboratory. Based on visual observations and laboratory tests, the soil descriptions in the boring logs are generally made in accordance with the "Unified Soil Classification System."

LABORATORY TESTS

Laboratory tests for on-site soils included: natural water content, Atterberg limits, specific gravity, sieve analysis, AASHO T-180-57 density, expansion and CBR.

A list of the standard field and laboratory test methods used for this project is given in the Appendix.

A summary of the laboratory test results is given in Tables IA and IB.

GENERAL SITE CONDITIONS

The proposed resort site is east of Kalanianaole Highway and north of Wawamalu Stream.

The area abuts two tidal inlets, Wawamalu Stream channel outlet known as Kaloko and the drainage outlet for Kealakipapa Valley. Access roads cross portions of the site. Existing fills or stockpiled soils were noted along the northern and southern portions of the site.

Grass, saltwater plants and low brush cover most of the area. The site generally slopes towards the shoreline at 2 to 5% gradient with steeper slopes in localized areas. Lava outcrops were noted along the shoreline

with localized accumulations of sand and coral fragments. Lava outcrops were also noted adjacent to the highway along Wawamalu Stream. Muck was encountered at the tidal inlet into which the drainage from Kealakipapa Valley discharges.

INTERPRETATION OF SOIL CONDITIONS

From the field exploration, the soils at the site may be generally described as follows:

Fills or stockpiles of about 1 to 12 ft of medium to dense silty and clayey sand with gravel and coral fragments were noted along the northern boundary and on the north bank of Wawamalu Stream. Underlying the fills was lava rock to about 7 to 16 ft, the depths drilled.

Boring No. 89 in the northeast section of the site indicated surface layers about 10 ft of clay (adobe) with decomposed rocks and boulders underlain by lava rock to about 15 ft, the depths drilled.

In the east section, near the outlet of the natural drainageway, shallow muck deposits of about 1 to 3 ft or more were underlain by rocky material.

Water was noted in several borings from about 1 to 11-ft depths. Because the resort area is exposed to open water, ground water level will probably vary closely with the tidal variations.

For more detailed descriptions of soils encountered in the drill holes, refer to the boring logs.

DISCUSSION AND RECOMMENDATIONS

The proposed plan is to grade the site for resort development with fills generally less than 15 to 20 ft in height.

Some fills are contemplated along the shoreline of the tidal inlet in the eastern section of the site. Portions of the fill may extend below the water line.

Site Grading

All surface vegetation and miscellaneous debris should be cleared and removed prior to site filling. Localized soft pockets encountered during site preparations should be excavated and backfilled with compacted select material. Provisions to drain the site should be included during and after the completion of filling operations.

Grading work should be done in general conformance with the requirements of Chapter 23, Revised Ordinances of Honolulu, 1961 As Amended.

Fills Below Water

Fills below water should generally be constructed with fairly well-graded granular material such as coral or crushed rock. The material should generally be less than 6-in. maximum size

with less than 30% passing the No. 200 sieve for coral and less than 15% for materials with plastic fines.

Surface deposits of soft clayey soils and pockets of muck should be displaced or flushed out during placement of fills in wet areas. The fills may be placed by end dumping up to about elevation 3 to form a working platform. The working platform should be brought to a fairly level surface and compacted with vibratory equipment.

Controlled fills may be constructed above the working platform.

Controlled Fills

For the construction of fills generally above elevation +3 ft, the following is recommended:

1. Rubble, loose boulders and unsuitable materials should be removed.

2. Stockpiles and loose surface soils should generally be removed or scarified and recompacted before the placement of fills.

3. Hard surfaces along existing access roads should be scarified down to stiff soils and recompacted to match the density of the surrounding soils.

4. Loose soils along the sides of the natural drainageways and stream beds should be removed and the slopes reconstructed. Subdrains should be placed along the bottom and sides and the embankment constructed with compacted select fill material.

5. Fill material may be approved on-site or borrow soils. If practicable, fill material imported to the site should be select soils with a plasticity index generally less than 20.

6. Fills should be constructed in approximately level layers starting at the lower end and working upward. Where fills are made on sloping areas steeper than about 5 horizontal to 1 vertical, the ground at the toe of the fill should be benched to a generally level condition. As the fill is brought up, it should be continually keyed into the stiff natural ground by cutting steps into the slopes and compacting the fill into these steps.

7. Fills should be laid in 6-in. compacted layers with a relative density of at least 90% of AASHO T-180-57 density.

8. If clay (adobe) soils are used for fills, they should be placed preferably below 2 ft of finish grades, well above the ground water level and several feet from the face of fill slopes. Adobe fill should be kept less than 10 ft in height and preferably less than 8 ft. See attached sketch, Figure 2.

9. If boulders are proposed to be used in the construction of fills, they should generally be placed along the toe sections of fill slopes and outside of probable building sites.

   Before placing any boulders, the subgrade should be stripped to stiff natural ground and shaped to drain. A layer of granular filter material should be placed on the subgrade and the boulders placed on the filter layer. The void spaces between boulders should be filled with granular material. A blanket of filter material should be placed against the boulders before any earth fills are placed against the boulders. See attached sketch, Figure 3.

Slopes

In general, for slopes above the water table, the following may be used as a guide:

1. Cut and fill slopes of 2 horizontal to 1 vertical or flatter should be used.

2. For low cuts thru mixtures of rock and clinkers, slope ratios of 1-1/2 horizontal to 1 vertical or flatter may be used.

3. For low cuts (less than 5+ ft in height) in rock that is fairly homogeneous, slope ratios of 3/4 horizontal to 1 vertical or flatter may be used.

If slope heights (top to toe) of greater than 15 ft are considered, 8-ft wide benches should be placed at height intervals of about 15 ft in both cuts and fills.

For protection against erosion, the runoff from rainstorms should be diverted by berms or ditches away from slopes whenever practicable.

The surface of fill slopes should be compacted by cat-tracking or with a sheepsfoot roller.

In general, slope planting is recommended on cut and fill slopes to minimize erosion.

Slopes exposed to open water and possible wave action should include some type of slope protection, such as rip-rap. Otherwise, flat slopes should be used depending on the type of soils used to construct the slopes.

Foundations

Light, short-span structures may be constructed at the site with ordinary footings or foundations.

Because lava rock may be encountered relatively close to the surface, high-rise buildings may be constructed with relatively simple foundations. The depth of the rock formation was not determined for this report. More explorations should be made for the design of a specific structure and location.

For heavy or long-span or multiple story structures, foundation explorations should be made at each building site to evaluate the ground conditions before foundations are designed.

The following may be used as a guide for foundation design for light, short-span structures:

1. Bearing values for a given soil vary with the size and depth of footings. For light, one and 2-story, short-span structures, bearing values of about 2000 p.s.f. may be used.

2. If soft spots or pockets of loose material are encountered in footing excavations or below a building area, they should be excavated and replaced with compacted select on-site or borrow soils.

3. Foundation design adjustments must be made if adobe soils are encountered or imported. Care should be taken that there is at least 2 ft of compacted select material below building footings in adobe areas.

4. Concrete slab on ground should be placed over a base course of 4 in. of well-graded gravel less than 3/4 in. and greater than 1/4 in. in size. The subgrade should be compacted and shaped to a level surface or to drain, if practicable, and generally should be kept slightly higher than the finish grade outside of the building.

5. In general, buildings and structures should be placed about 15 ft from the tops of slopes.

6. Construction of retaining walls on slopes should generally be avoided.

7. Good surface drainage away from the foundation of structures should be maintained and the site should be graded at all times to prevent ponding of water.

Roadway

In general, a rough estimate of the roadway pavement thickness for the light residential traffic anticipated is as follows:

1. Wearing course - 2-in. asphaltic concrete.

2. Base course - 6-in. base course over a prepared subgrade.

Provisions should be made in the contract documents to allow for local adjustments regarding subbase requirements in the field as ground conditions are exposed at subgrade levels. The subbase thickness will depend upon the type of material within the top 2 ft of subgrade.

The subgrade should be compacted and shaped to drain. To avoid the ponding of water and softening of the subgrade at low points, weep holes should be placed at subgrade levels through the walls of catch basins which are placed in these low areas.

Utilities

Although the probability of differential settlements in localized areas is slight in this area, utilities should be placed after the fills are constructed. Utility lines should be designed with flexible joints, particularly where lines are connected to structures. Gravity flow lines should be made as steep as practicable.

Unforeseen or undetected conditions may occur in localized areas and will have to be adjusted and corrected in the field as they are detected.

PROPOSED SPECIFICATION FOR EARTHWORK

RESORT NO. 2

General Description

This item shall consist of clearing and grubbing, removing of existing structures, preparing of land to be filled, excavating and filling of the land, spreading, compacting and testing of the fill, and subsidiary work necessary to complete the grading.

Clearing, Grubbing and Preparing Areas to be Filled

Vegetation, concrete slabs and rubbish shall be removed and disposed of, leaving the disturbed area with a neat, debris-free appearance.

Vegetable matter shall be removed from the surface upon which fill is to be placed. Topsoil and stockpiled soils shall be (1) stripped to stiff natural ground or (2) scarified and recompacted before the placement of fills. Topsoil encountered at finish grade shall be scarified and recompacted.

Hard surfaces along the existing access roads shall be scarified down to stiff soils and recompacted to match the density of the surrounding soil before the placement of fills.

Where fills are proposed in sidehill areas and gullies, loose material along the bottom and the sides shall be stripped down to stiff natural ground before the placement of fills. New fills shall be keyed into the stiff natural ground.

Subdrains shall be placed along the bottom and sides of the natural drainageways before the construction of fills. The locations of subdrains should be determined in the field after clearing and grubbing.

Where fills are made on sloping areas steeper than 5 horizontal to 1 vertical, the ground at the toe of the slope shall be benched to a generally level condition. As the fill is brought up, it shall be continually keyed into the stiff natural ground by the cutting of steps into the hillside and compacting the fill into these steps. Ground slopes which are flatter than 5 horizontal to 1 vertical shall be benched when considered necessary by the Soil Engineer.

Materials

Fill materials shall consist of approved on-site or borrow soils. The soils shall contain no more than a trace of organic matter. Fill material imported to the site shall be select soils with a plasticity index less than 20.

Placing, Spreading and Compacting Fill Material

The selected fill material shall be placed in level layers which, when compacted, shall not exceed 6 inches. Each layer shall be spread evenly and thoroughly blade-mixed during the spreading to insure uniformity of material and water content within each layer.

No rocks or cobbles shall be allowed to nest and voids between rocks must be carefully filled and compacted with small stones or earth.

When the water content of the fill material is well below the optimum for compacting purposes, water shall be added until the water content assures a thorough bonding during the compacting process.

When the water content of the material is well above the optimum for compacting purposes, the fill material shall be aerated by blading or by other satisfactory methods until the water content is near the optimum.

After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to no less than 90% of maximum density in accordance with AASHO Test No. T-180-57 or other comparable density tests. Compaction shall be with sheepsfoot rollers, multiple-wheel pneumatic-tired rollers or other acceptable rollers which shall be able to compact the fill to the specified density. Rolling shall be accomplished while the fill material is near the optimum water content. The rolling of each layer shall be continuous over its entire area and the roller shall make sufficient passes to insure the obtainment of the desired density.

Field density tests shall be made to get an indication of the compaction of the fill. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density readings shall be taken as often as necessary in the compacted material below the disturbed surface. When these readings indicate that the density of any layer of fill or portion thereof is below the required 90% density, that layer or portion shall be reworked until the required density has been obtained.

The fill operation shall be continued in 6-in. compacted layers as specified above, until the fill has been brought to the finished slopes and grades as shown on the accepted plans.

Excavation

Suitable material from excavation shall be used in the fill and unsuitable material from excavation shall be disposed of.

Fills Below Water

Fills below water shall be constructed with fairly well-graded granular material such as coral or crushed rock. The material shall be less than 6-in. maximum size with less than 30% passing the No. 200 sieve for coral and less than 15% for materials with plastic fines.

Surface deposits of soft clayey soils and pockets of muck shall be displaced or flushed out during placement of fills in wet areas. The fills may be placed by end dumping up to about elevation 3 to form a working platform. The working platform shall be brought to a fairly level surface and compacted with vibratory equipment.

Controlled fills may be constructed above the working platform.

Boulder Fills

If boulders are proposed to be used in the construction of fills, they shall be placed along the toe section of slopes and at locations indicated on the plan. The subgrade shall be stripped to stiff natural ground and shaped to drain. A layer of granular filter material shall be placed on it. All voids between boulders shall be filled with smaller granular soils. A blanket of filter material shall be placed against the boulder fill before construction of earth fills behind or above the boulders.

Unforeseen Conditions

If unforeseen or undetected critical soil conditions such as soft spots are encountered during the field operation, corrective measures shall be made in the field as they are detected.

Rainy Weather

No fill material shall be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests indicate that the water content and density are as previously specified.

BORING LOGS

Symbols

Symbols used generally are in accordance with the Unified Soil Classification System.

Where a parenthesis "(MH)" is used, the soil sample was classified by visual observation of the sample recovered.

Where no parenthesis "MH" is used, the soil sample was classified from either the Atterberg limits or sieve analysis test results.

Note

Boring No. 83 was not made. Rock outcrops may be visually observed at this location.

WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: RESORT NO. 2

LOCATION: Maunalua, Oahu, Hawaii

Tax Map Key: 3-9-11

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 80 Sheet No. ____ of ____

Driller: Walter Lum Assoc. Date: 4-6,7-70

Field Party: SETO, GLORY

Type of Boring: AUGER (ACKER ACE) Diam.: 3"

Elev.: 14' ± * Datum: —

Drill Bit: T.C. DRAG BIT

Water Level: NOT NOTICED

Time: —

Date: 4-7-70

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: STANDARD PENETRATION TEST, Blows Per Foot (0 10 20 30)
	ELEV. = 14' ± *2	0									
	BROWN SILTY SAND W/GRAVEL			80A	ROCK FRAGMENT				-	-	20/.2' HAMMER BOUNCES
	LAVA ROCK										
		5		80B	NO RECOVERY				-	-	20/.0'
	END OF BORING @ 6.5' ±										

4-6-70 ↓ 4-7-70

NOTE:
TWO BORINGS ATTEMPTED 20'± APART WERE SIMILAR.
FIRST ATTEMPT 3'± DEPTH
SECOND ATTEMPT 6.5'± DEPTH

* ELEVATION ESTIMATED FROM CONTOUR MAP

WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: RESORT NO. 2

LOCATION: Maunalua, Oahu, Hawaii

Tax Map Key: 3-9-11

HAMMER:

Weight: 10 # SLEDGE HAMMER

Drop: —

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 81 Sheet No. ____ of ____

Driller: Walter Lum Assoc. Date: 4-2-70

Field Party: KAKU, MEYER

Type of Boring: AUGER Diam.: 4"

Elev.: 5' ± * Datum: ____

Drill Bit: T.C. DRAG

Water Level	NOT NOTICED			
Time	3:40 PM			
Date	4-2-70			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler		Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: W/ 10 lb. SLEDGE HAMMER
	ELEV. = 5' ± *2	0										
	LOOSE, TANNISH BROWN SILTY SAND W/ GRAVEL & COBBLES, BROWN W/ RED CLAY		CUTTINGS		81	-	40	-	-	-		
	LAVA ROCK W/ CLINKER POCKET FROM 4.6' TO 6'	5	2"SS		81A	ROCK FRAGMENT				-		20/1"
	END OF BORING @ 10' ±	10										

* ELEVATION ESTIMATED FROM CONTOUR MAP

WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: RESORT NO. 2

LOCATION: Maunalua, Oahu, Hawaii

Tax Map Key: 3-9-11

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 82 Sheet No. ____ of ____

Driller: Walter Lum Assoc. Date: 4-6-70

Field Party: SETO, GLORY

Type of Boring: AUGER (ACKER ACE) Diam.: 3"

Elev.: 0'± * Datum: ____

Drill Bit: T.C. DRAG

Water Level	0.5'			
Time	11:00 AM			
Date	4-6-70			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 0'± *	0								
(GP-GM)	SAND, GRAVEL & CORAL (COBBLES & BOULDERS ON THE SURFACE)		WATER 4-6-70	82A	—	25	-	-	-	
MH	GRAY & BROWN, SILTY CLAY W/SAND	5				47				
(MH)	GRAY CLAYEY SILT W/ SAND & GRAVEL			82B	-	37	-	-	-	14/.3'
	LAVA ROCK W/ CLINKER POCKET	10		82C	-	ROCK FRAGMENT	-	-	-	30/.2' HAMMER BOUNCES
				82D	-	33	-	-	-	
	END OF BORING @ 13' ±									

* ELEVATION ESTIMATED FROM CONTOUR MAP

WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: RESORT NO. 2

LOCATION: Maunalua, Oahu, Hawaii

Tax Map Key: 3-9-11

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 84 Sheet No. ____ of ____

Driller Walter Lum Assoc. Date 4-6-70

Field Party LUNING, MAESHIRO

Type of Boring AUGER (CONCORE A-5 Jr.) Diam. 4"

Elev. 2'± * Datum —

Drill Bit T.C. DRAG

Water Level 3.0'
Time 3:00 PM
Date 4-6-70

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Uncont. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 2'± *	0								
(SM)	SAND & CORAL		WATER 4-6-70	84A	—	14	—	—	—	
	BOULDER OR ROCK									
		5								
(SP)	WHITE, SAND W/CORAL FRAGMENTS			84B	—	12	—	—	—	
	LAVA ROCK	10		84C	ROCK FRAGMENT				—	30/.1
	END OF BORING @ 10'±									

NOTE:
TWO BORINGS ATTEMPTED ABOUT 10' APART.
FIRST ATTEMPT 2'± DEPTH. (DRILLED 0.5' TO 2'± 40 MIN.)
SECOND ATTEMPT 10'± DEPTH (LOG SHOWS 2ND HOLE)

*ELEVATION ESTIMATED FROM CONTOUR MAP.

WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: RESORT NO. 2

LOCATION: Maunalua, Oahu, Hawaii

Tax Map Key: 3-9-11

HAMMER:
Weight: 140"
Drop: 30"

SAMPLER: 2"-SS 2" STANDARD SPLITSPOON
2"-S 2" O.D. THIN WALL TUBE

BORING NO. 85 Sheet No. ____ of ____

Driller: Walter Lum Assoc. Date: 4-7-70

Field Party: LUNING, MAESHIRO

Type of Boring: AUGER (CONCORE A-5 Jr) Diam.: 4"

Elev.: 5'± * Datum: —

Drill Bit: T.C. DRAG

Water Level					
Time	—				
Date	4-7-70				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler		Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2" O.D. THIN WALL TUBE BLOWS/0.5'
	ELEV. 5'± *	0										
(ML)	MEDIUM, REDDISH BROWN CLAYEY SILT w/ SAND		2-S		85A	—	17	—	—	—		6/.5 8/.5
	LAVA ROCK											
	VOID (4' TO 4.5'±)	5										
			2-SS		85B	ROCK FRAGMENT				—		20/0' HAMMER BOUNCES
	LAVA ROCK		2-SS		85C	—	NO RECOVERY			—		20/0'
	END OF BORING @ 7'±											

* ELEVATION ESTIMATED FROM CONTOUR MAP

WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: RESORT NO. 2

LOCATION: Maunalua, Oahu, Hawaii

Tax Map Key: 3-9-11

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 86 Sheet No. ____ of ____

Driller: Walter Lum Assoc. Date: APRIL 7, 1970

Field Party: LUNING, MAESHIRO

Type of Boring: AUGER (CONCORE A-5 JM) Diam.: 4"

Elev.: 24'± * Datum: —

Drill Bit: T.C. DRAG

Water Level: NOT NOTICED

Time: —

Date: 4-7-70

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 24'± *	0								
(SM)	BROWN-WHITE SILTY SAND W/ COBBLES			86A	-	10	-	-	-	
CH	MEDIUM BROWN, CLAY W/ COBBLES	5		86B	-	29	-	-	-	
(ML)	MEDIUM, BROWN CLAYEY SILT W/DECOMPOSED ROCK	10		86C	-	15	-	-	-	
	BOULDER OR ROCK	15		86D	NO	RECOVERY			-	20/0'
	END OF BORING @ 14'									

* ELEVATION ESTIMATED FROM CONTOUR MAP

WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: RESORT NO. 2

LOCATION: Maunalua, Oahu, Hawaii

Tax Map Key: 3-9-11

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2"ss- 2" STANDARD SPLIT SPOON

BORING NO. 87 Sheet No. ____ of ____

Driller: Walter Lum Assoc. Date: MAY 16, 1970

Field Party: MEYER, MAESHIRO

Type of Boring: AUGER (ACKER ACE) Diam.: 4"

Elev.: 23' ± * Datum: —

Drill Bit: T.C. DRAG

Water Level	NOT NOTICED			
Time	—			
Date	5-16-70			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 23' ± *	0								
(SM)	MEDIUM, BROWN, SILTY SAND W/ GRAVEL & CORAL FRAGMENTS		2"ss	87-A	-	12	-	-	-	
		5	2"ss	87-B	-	11	-	-	-	
	STIFF, DARK BROWN, SILTY CLAY									
(ML)	DECOMP. ROCK W/ REDDISH BROWN CLAYEY SILT	10	2"ss	87-C	-	11	-	-	-	
	PUKA PUKA ROCK	15	2"ss	87-D	-	ROCK FRAGMENTS			-	41
	END OF BORING @ 16.0'									

*ELEVATION ESTIMATED FROM CONTOUR MAP

WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

BORING NO. 88 Sheet No. ____ of ____

PROJECT RESORT NO. 2

LOCATION Maunalua, Oahu, Hawaii

Tax Map Key: 3-9-11

Driller Walter Lum Assoc. Date MAY 16, 1970

Field Party MEYER, MAESHIRO

Type of Boring AUGER (ACKER ACE) Diam. 4"

Elev. 19'± * Datum —

Drill Bit T. C. DRAG

HAMMER:

Weight 140#

Drop 30"

SAMPLER: 2"ϕ - 2" STANDARD SPLIT SPOON

Water Level				
Time	—			
Date	5-16-70			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 19'± *	0								
SM	MEDIUM DENSITY, BROWN, SILTY SAND W/CORAL		2"ϕ	88-A	-	13	-	-	-	
(SC)	STIFF, BROWN, CLAYEY SAND W/GRAVEL & CORAL	5	2"ϕ	88-B	-	23	-	-	-	
	PUKA PUKA ROCK	10	2"ϕ	88-C	- ROCK FRAGMENTS				-	30/.2 HAMMER BOUNCES
	END OF BORING @ 15'	15	2"ϕ	88-D	- NO RECOVERY				-	20/.0 HAMMER BOUNCES

* ELEVATION ESTIMATED FROM CONTOUR MAP

WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: RESORT NO. 2

LOCATION: Maunalua, Oahu, Hawaii

Tax Map Key: 3-9-11

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2"ss - 2" STANDARD SPLIT SPOON

BORING NO. 89 Sheet No. ____ of ____

Driller: Walter Lum Assoc. Date: MAY 16, 1970

Field Party: MEYER, MAESHIRO

Type of Boring: AUGER (ACKER ACE) Diam.: 4"

Elev.: 11'± * Datum: —

Drill Bit: T.C. DRAG

Water Level	NOT NOTICED			
Time	—			
Date	5-16-70			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 11'± *?	0								
(CH)	STIFF, DARK BROWN, CLAY (ADOBE)		2"ss	89-A	-	37	-	-	-	
	BOULDER	5								
(CH)	STIFF, BROWN, CLAY W/GRAVEL & PUKA PUKA ROCK		2"ss	89-B	-	25	-	-	-	
(CH)	STIFF, GRAY, CLAY	10	2"ss	89-C	-	36	-	-	-	20/.5 HAMMER BOUNCES
	PUKA PUKA ROCK	15	2"ss	89-D	- ROCK FRAGMENTS				-	30/.2 HAMMER BOUNCES
	END OF BORING @ 15.2'									

* ELEVATION ESTIMATED FROM CONTOUR MAP

WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: RESORT NO. 2

LOCATION: Maunalua, Oahu, Hawaii

Tax Map Key: 3-9-11

HAMMER:

Weight:

Drop:

SAMPLER:

BORING NO. 20 A, B, & C Sheet No. _____ of _____

Driller WALTER LUM ASSOC. Date SEPT. 2, 1970

Field Party FUJII, MAKAULA

Type of Boring HAND AUGER Diam. 3"

Elev. 0'± * Datum

Drill Bit	20 A	20 B	20 C		
Water Level	0.5'±	0.3'±	1.0'±		
Time	10:20 AM	10:35 AM	9:50 AM		
Date	9-2-70	9-2-70	9-2-70		

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	BORING NO. 20 A ELEV. = 0'± * ▽ WATER	0								
(CH)	GRAYISH BROWN, CLAY W/SAND					67				
	ROCK OR SAND	5								
	END OF BORING @ 3'									
	BORING NO. 20 B ELEV. = 0'± * ▽ WATER	0								
(CH)	GRAYISH BROWN, CLAY W/SOME SAND					71				
	ROCK	5								
	END OF BORING @ 0.5'									
	BORING NO. 20 C ELEV. = 0'± * ▽ WATER	0								
(OH)	BLACK ORGANIC CLAY (MUCK)					108 129				
	ROCK	5								
	END OF BORING @ 1.5'									

* ELEVATION ESTIMATED FROM CONTOUR PLAN

WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: RESORT NO. 2

LOCATION: Maunalua, Oahu, Hawaii

Tax Map Key: 3-9-11

HAMMER:

Weight: 140 #

Drop: 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 91 Sheet No. ____ of ____

Driller: Walter Lum Assoc. Date: 5-21-70

Field Party: MAKAULA, MAESHIRO

Type of Boring: AUGER (ACKER ACE) Diam.: 4"

Elev.: 3'± * Datum: ____

Drill Bit: T.C. DRAG.

Water Level	NOT NOTICED			
Time				
Date	5-21-70			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. 3'± *	0								
(SP-SM)	MEDIUM DENSITY SAND W/ CORAL FRAGMENTS & SHELLS			91A	-	12	-	-	-	
		5		91B	-	19	-	-	-	41/.5
	PUKA PUKA ROCK									
		10		91C	ROCK FRAGMENT				-	40/.1
	END OF BORING @ 10'±									HAMMER BOUNCES

*ELEVATION ESTIMATED FROM CONTOUR MAP

WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: RESORT NO. 2

LOCATION: Maunalua, Oahu, Hawaii

Tax Map Key: 3-9-11

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2"ϕ S-2" STANDARD SPLIT SPOON

BORING NO. 92 Sheet No. ____ of ____

Driller: Walter Lum Assoc. Date: MAY 19, 1970

Field Party: MAKAULA, MAESHIRO

Type of Boring: AUGER (ACKER ACE) Diam.: 4"

Elev.: 7'± * Datum: —

Drill Bit: T. C. DRAG

Water Level				
Time	—			
Date	5-19-70			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. 7'± *	0								
	MEDIUM, BROWN, SILTY SAND & CORAL FRAGMENTS		2"ϕ S	92-A	—	12	—	—	—	25/.5
(CH)	STIFF, BROWN, CLAY	5	2"ϕ S	92-B	—	40	—	—	—	25/.2 HAMMER BOUNCES
	PUKA PUKA ROCK	10	2"ϕ S	92-C	- ROCK FRAGMENTS				—	45/.2 HAMMER BOUNCES
	END OF BORING @ 10.2'									

*ELEVATION ESTIMATED FROM CONTOUR MAP

WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: RESORT NO. 2

LOCATION: Maunalua, Oahu, Hawaii

Tax Map Key: 3-9-11

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2"ϕ - 2" STANDARD SPLIT SPOON

BORING NO. 93 Sheet No. ____ of ____

Driller: Walter Lum Assoc. Date: MAY 18, 1970

Field Party: MAKAULA, MAESHIRO

Type of Boring: AUGER (ACKER ACE) Diam.: 4"

Elev.: 5'± * Datum: —

Drill Bit: T.C. DRAG

Water Level					
Time	—				
Date	5-18-70				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 5'± *	0								
(CH)	MEDIUM, DARK BROWN, CLAY		2"ϕ	93-A	-	50	-	-	-	
		5	2"ϕ	93-B	- ROCK FRAGMENTS				-	30/.1' HAMMER BOUNCES
	PUKA PUKA ROCK	10	2"ϕ	93-C	- ROCK FRAGMENTS				-	35/.2' HAMMER BOUNCES
		15	2"ϕ	93-D	- NO RECOVERY		-	-		25/.0' HAMMER BOUNCES
	END OF BORING @ 15'									

* ELEVATION ESTIMATED FROM CONTOUR PLAN

WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: RESORT NO. 2

LOCATION: Maunalua, Oahu, Hawaii
Tax Map Key: 3-9-11

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2"ϕ - 2" STANDARD SPLIT SPOON

BORING NO. 94 Sheet No. ____ of ____

Driller: Walter Lum Assoc. Date: MAY 19, 1970

Field Party: MAKAULA, MAESHIRO

Type of Boring: AUGER (ACKER ACE) Diam.: 4"

Elev.: 12' ± * Datum: —

Drill Bit: T.C. DRAG

Water Level	11.5'				
Time	3:00 PM				
Date	5-19-70				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 12' ± *?	0								
	LAVA ROCK (CLINKERS) W/TRACES OF BROWN, CLAYEY SILT		2"ϕ	94-A	-	15	-	-	-	
CH	MEDIUM, RED-BROWN, CLAY W/PUKA PUKA ROCK	5	2"ϕ	94-B	-	28	-	-	-	
	5-19-70 WATER ▽	10	2"ϕ	94-C	- ROCK FRAGMENTS -					30/.5'
	LAVA ROCK W/ BLACK SAND	15	2"ϕ	94-D	-	21	-	-	-	31/.5'
	END OF BORING @ 16'									

* ELEVATION ESTIMATED FROM CONTOUR PLAN

RESORT NO. 2

TABLE I A - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	B0	B2	B5	B6
SAMPLE NO.		B (TOP)		B
DEPTH BELOW SURFACE	SURFACE	5'-6.8'	SURFACE	5'-6.5'
DESCRIPTION	BROWN SILTY SAND W/GRAVEL	GRAY & BROWN SILTY CLAY W/SAND	BROWN CLAYEY SAND W/MUDROCK	BROWN CLAY
GRAIN-SIZE ANALYSIS (% Passing)				
Sieve				
1"	100		100	
1/2"	94.3		99.1	
#4	92.2		92.8	
#10	88.8		85.2	
#20	75.5		74.4	
#40	60.0		56.5	
#100	51.5		42.7	
#200	46.7		39.0	
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	NATURAL
Liquid Limit	45	55	56	95
Plastic Limit	29	30	25	29
Plasticity Index	16	25	31	66
Dilatancy	QUICK	SLOW	SLOW	NONE
Toughness	SLIGHT	MEDIUM	MEDIUM	HIGH
Dry Strength	SLIGHT-MED.	MEDIUM	MEDIUM	HIGH
UNIFIED SOIL CLASSIFICATION	SM	MH	SC	CH
APPARENT SPECIFIC GRAVITY	2.85		2.89	
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %	18.0		16.7	
Molding Dry Density, P.C.F.	107.9		106.5	
Swell upon saturation, %	0.9		3.6	
CBR at 0.1" Penetration	22.2		5.1	
MOISTURE-DENSITY RELATIONS OF SOILS (AASHO T-180-57 Method ___)	A		A	
Dry to Wet or Wet to Dry	DRY TO WET		DRY TO WET	
Max. Dry Density (P.C.F.)	109.9		105.2	
Optimum Moisture (%)	16.8		20.0	

REMARKS:

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 9-1-70 By BT.

2-4-70

RESORT NO. 2

TABLE I B - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	94			
SAMPLE NO.	B			
DEPTH BELOW SURFACE	5'-6.5'			
DESCRIPTION	RED-BROWN CLAY W/DECOMP. ROCK			
GRAIN-SIZE ANALYSIS (% Passing)				
Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL			
Liquid Limit	55			
Plastic Limit	28			
Plasticity Index	27			
Dilatancy	QUICK			
Toughness	MEDIUM			
Dry Strength	MEDIUM			
UNIFIED SOIL CLASSIFICATION	CH			
APPARENT SPECIFIC GRAVITY				
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %				
Molding Dry Density, P.C.F.				
Swell upon saturation, %				
CBR at 0.1" Penetration				
MOISTURE-DENSITY RELATIONS OF SOILS (AASHO T-180-57 Method ___)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

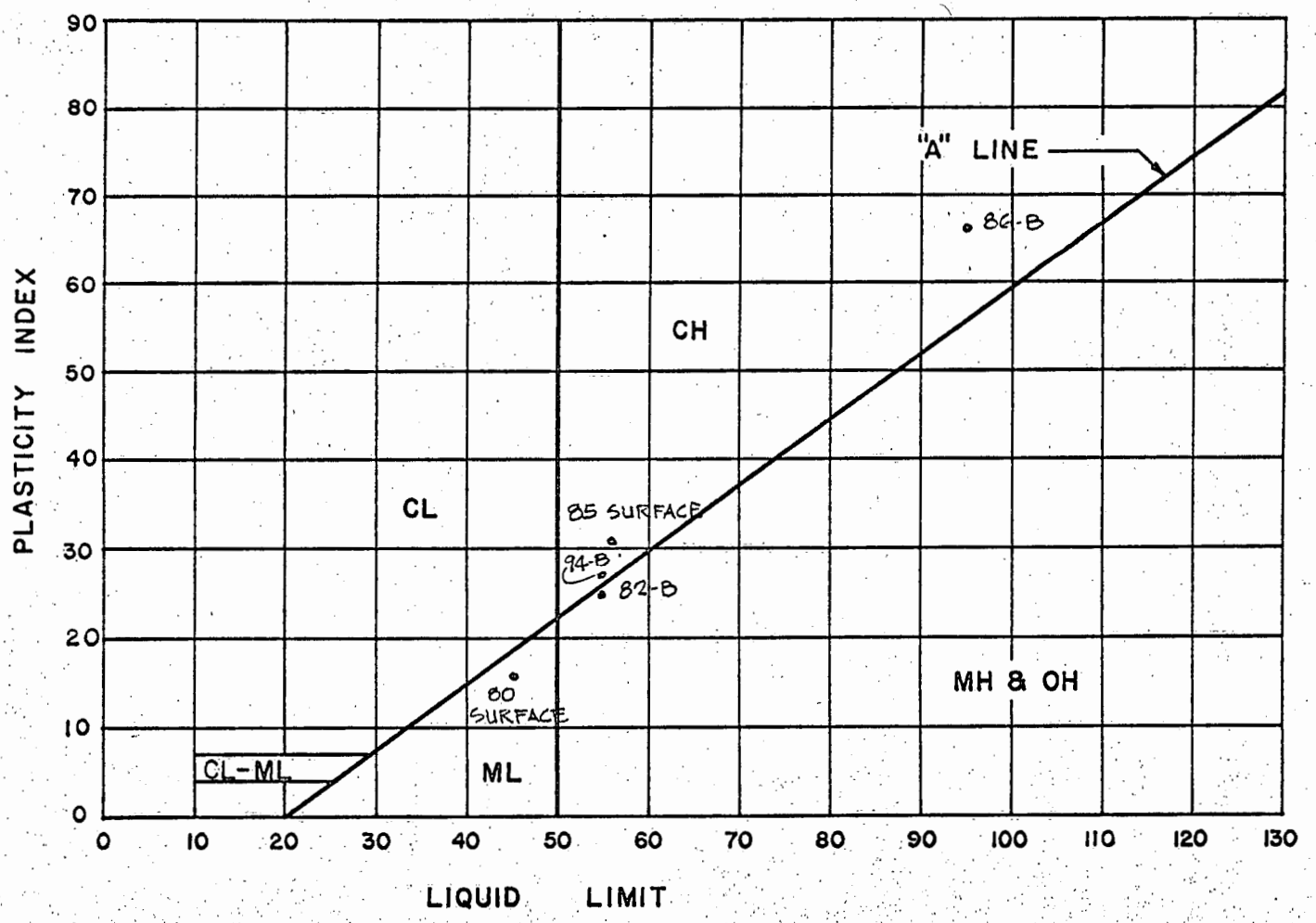
Date 9-1-70 By BT

3-470

PLASTICITY CHART

PROJECT: RESORT NO. 2

LOCATION: MAUNALUA, OAHU, HAWAII



WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

DATE 9-1-70 BY C.M

MOISTURE-DENSITY CURVE (AASHO T-180-57, METHOD A)

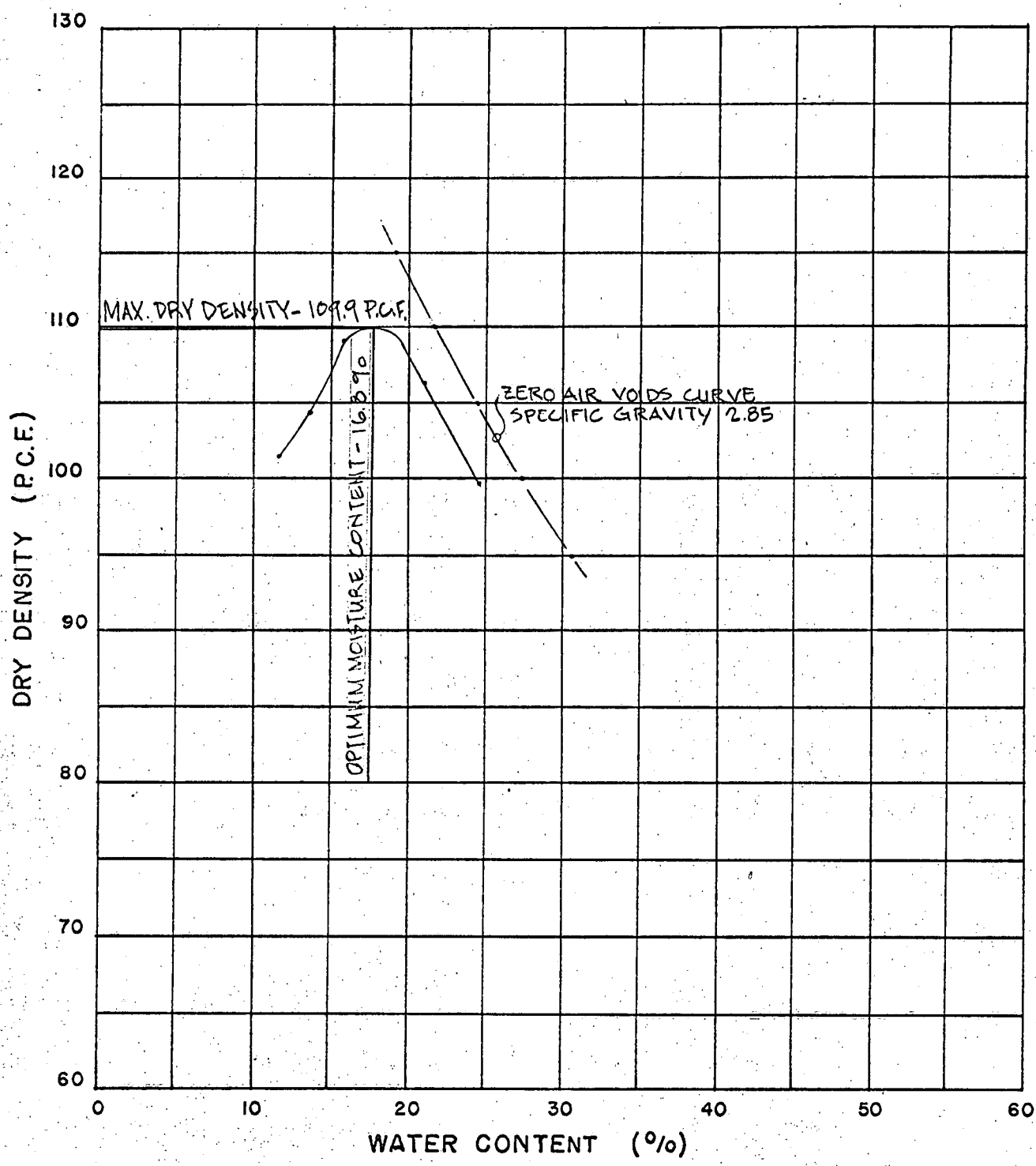
PROJECT: RESORT NO. 2

LOCATION: MAUNALUA, OAHU, HAWAII

SAMPLE NO.: 80-SURFACE

SAMPLE DESCRIPTION: BROWN SILTY SAND

AGGREGATE: 1/4" MINUS
MOLD SIZE: 4" Φ 4.5"
HAMMER: 10 LBS. 18" DROP
LAYERS: 5
BLOWS: 25 PER LAYER



WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

DATE 8-3-70 BY S.T.

MOISTURE–DENSITY CURVE (AASHO T-180-57, METHOD A)

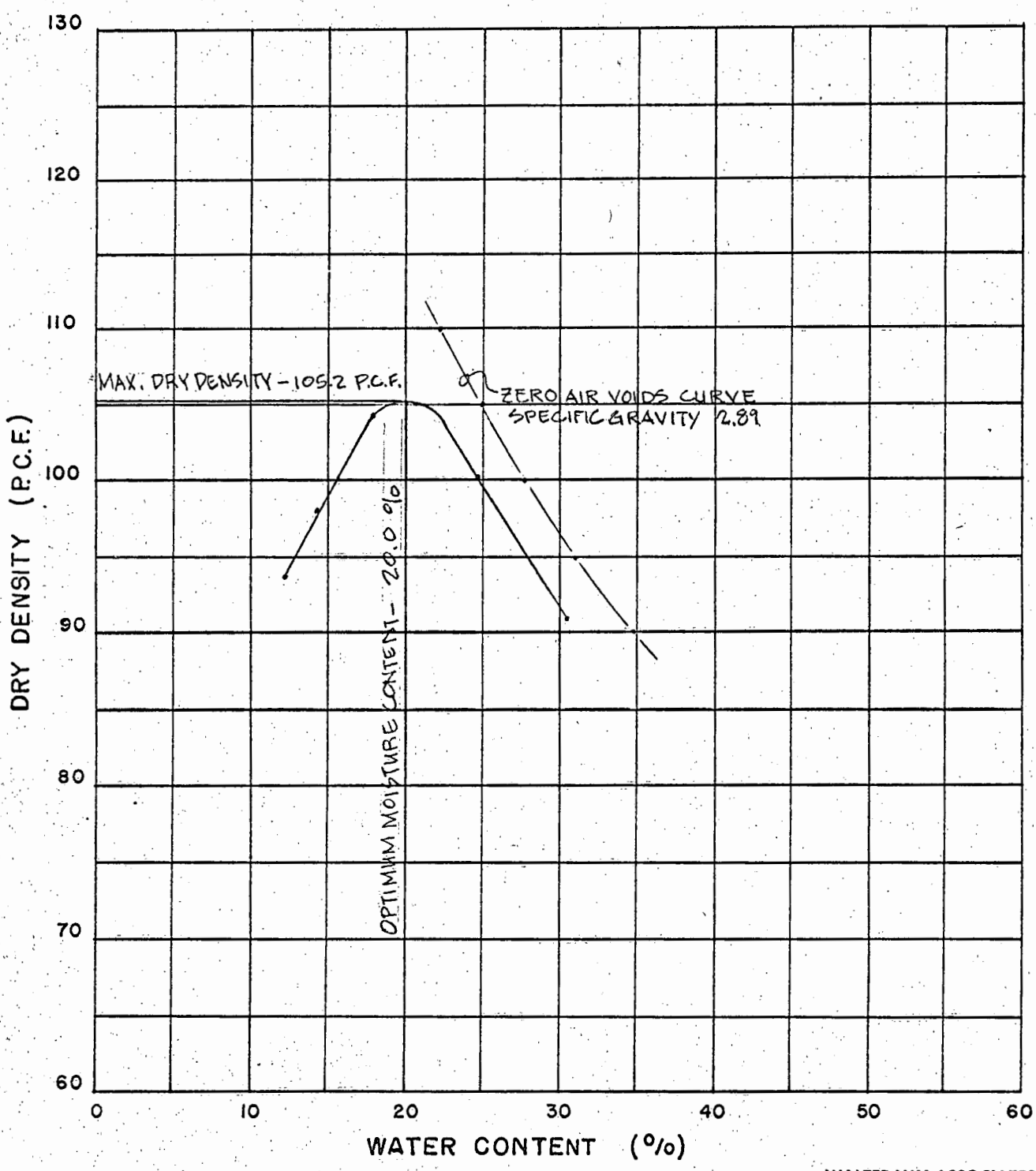
PROJECT: RESORT NO.2

LOCATION: MAUNALUA, OAHU, HAWAII

SAMPLE NO.: 85-SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SAND

AGGREGATE: ¼" MINUS
MOLD SIZE: 4" ⌀ 4.59"
HAMMER: 10 LBS 18" DROP
LAYERS: 5
BLOWS: 25 PER LAYER



WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

DATE 7-31-70 BY S.T.

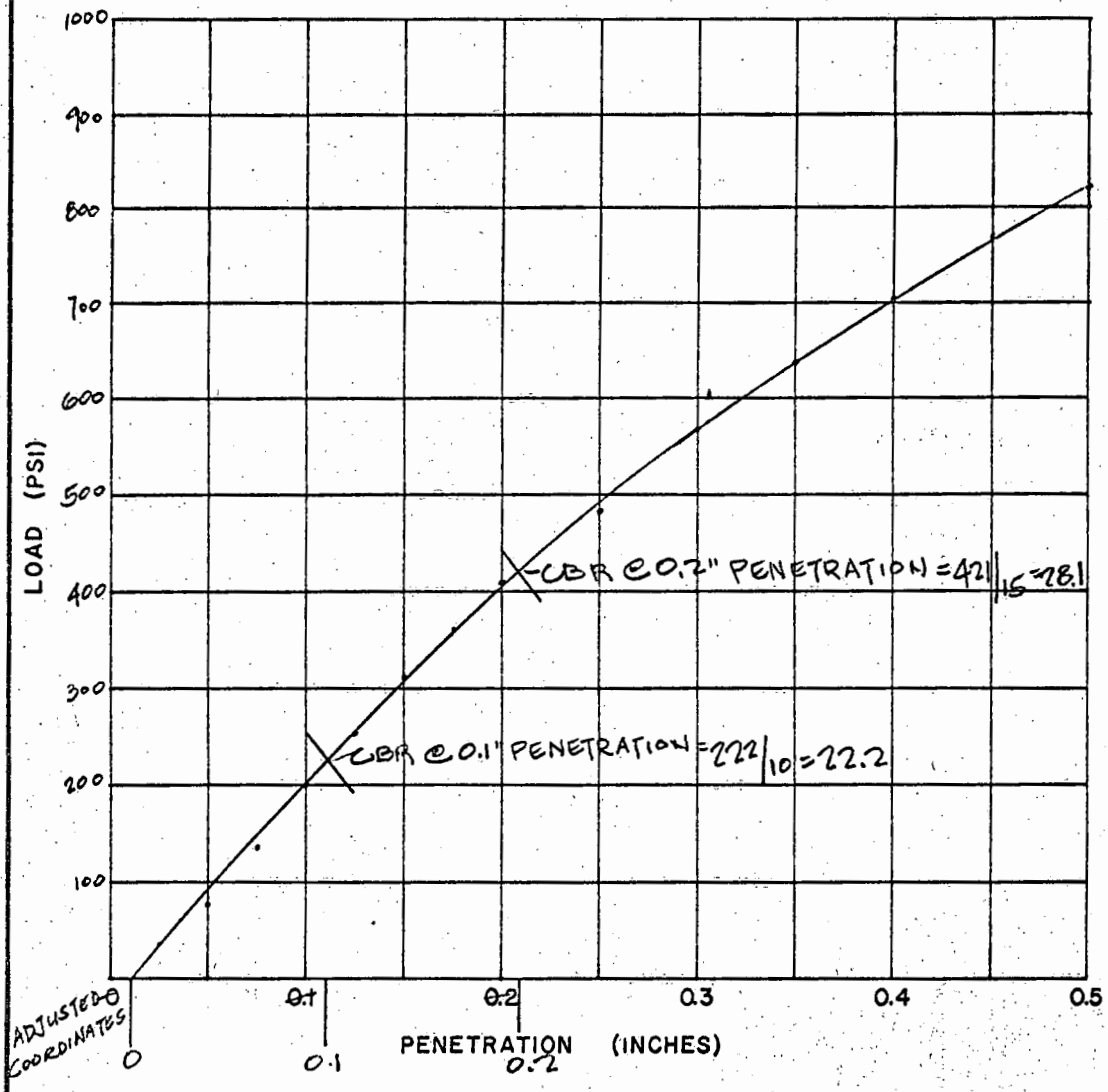
CBR TEST

PROJECT: RESORT NO. 2

LOCATION: MAUNALUA, OAHU, HAWAII

SAMPLE NO: 80-SURFACE

SAMPLE DESCRIPTION: BROWN SILTY SAND



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	115	38
0.050	230	77
0.075	410	137
0.100	600	200
0.125	775	258
0.150	935	312
0.175	1085	362
0.200	1230	410
0.250	1450	483
0.300	1720	573
0.350	1920	640
0.400	2115	705
0.450	2320	773
0.500	2470	823

AGGREGATE 1/4" MINUS

HAMMER WEIGHT 10 LBS.

HAMMER DROP 18"

No. OF BLOWS 56

No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %. 18.0

MOLDING DRY DENSITY, P.C.F. 107.7

CBR @ 0.1" PENETRATION 22.2

DATE 7-28-70 BY A.F.

DATE 8-3-70 BY S.T.

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

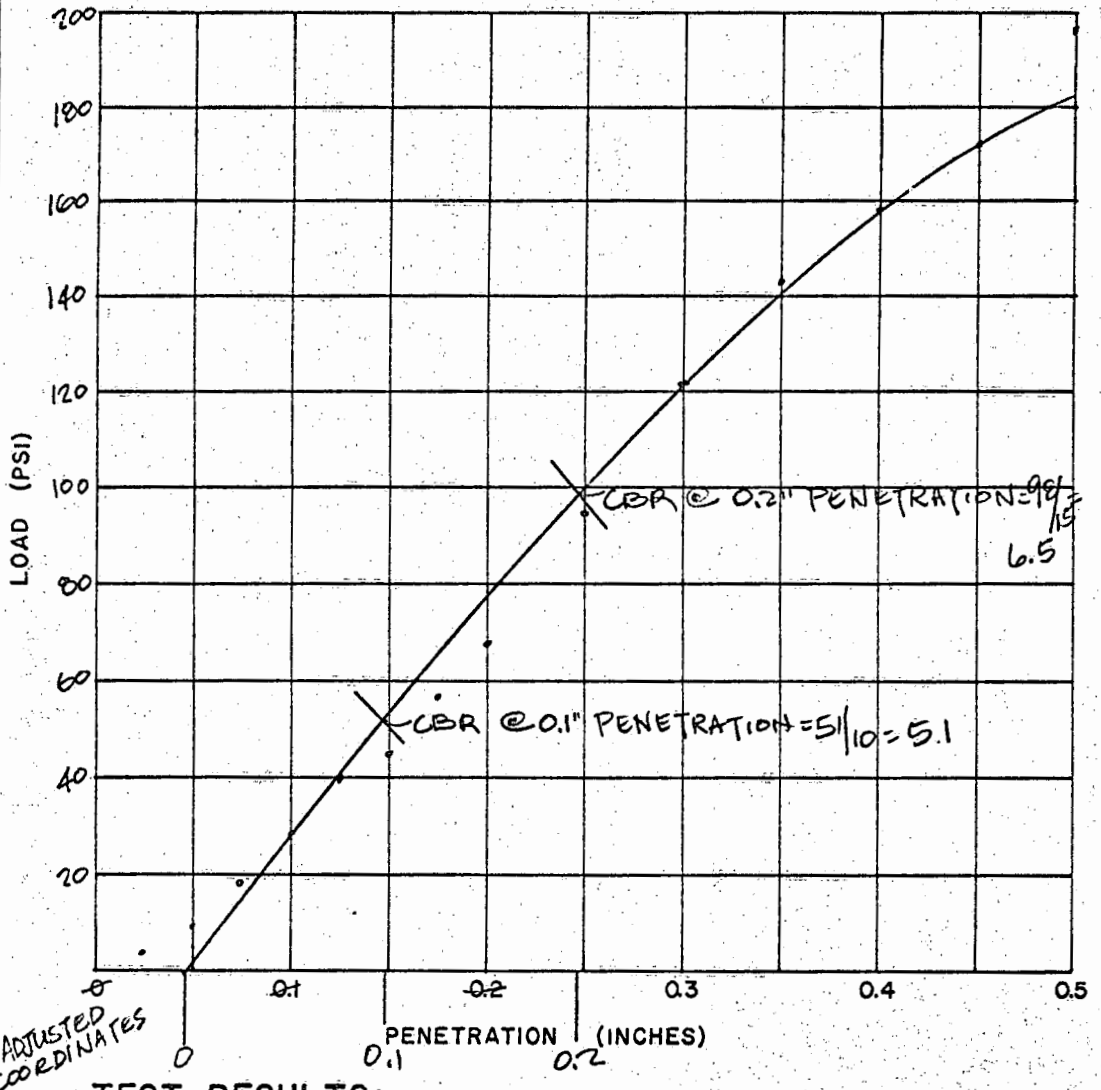
CBR TEST

PROJECT: RESORT NO. 2

LOCATION: MAUNALUA, OAHU, HAWAII

SAMPLE NO: 85-SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SAND



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	9	3
0.050	28	9
0.075	54	18
0.100	84	28
0.125	119	40
0.150	135	45
0.175	170	57
0.200	195	68
0.250	285	95
0.300	365	122
0.350	430	143
0.400	475	158
0.450	515	172
0.500	560	187

AGGREGATE 1/4" MINUS

HAMMER WEIGHT 10 LBS

HAMMER DROP 18"

No. OF BLOWS 56

No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %. 16.7

MOLDING DRY DENSITY, P.C.F. 106.5

CBR @ 0.1" PENETRATION 5.1

DATE 7-30-10 BY C.M.

DATE 8-4-10 BY S.T.

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

GENERAL TESTING METHODS

EXPLORATORY BORINGS AND SAMPLING

Method for soil investigation and sampling by auger borings (Tentative)	ASTM Designation: D 1452-63T
Method for thin wall tube sampling of soils (Tentative)	ASTM Designation: D 1587-63T
Method for penetration test and split barrel sampling of soils (Tentative)	ASTM Designation: D 1586-64T

LABORATORY TESTING

Grading Analysis

Sieve analysis of fine and coarse aggregates	AASHO Designation: T 27-60
Amount of material finer than No. 200 sieve in aggregate	AASHO Designation: T 11-60

Atterberg Limits

Determining the liquid limit of soils Modified as follows: Substitute Casagrande grooving tool. Tests conducted from natural moisture content unless noted otherwise.	AASHO Designation: T 89-60
Determining the plastic limit of soils	AASHO Designation: T 90-56
Calculating the plasticity index of soils	AASHO Designation: T 91-54

Specific Gravity

Specific gravity of soils Modified as follows: 500 ML Pycnometer	AASHO Designation: T 100-60

Expansion and CBR Tests

Expansion test and California Bearing Ratio (CBR)	Section VIII - TM 5-530 "Materials Testing" by Headquarters, Dept. of the Army

Compaction Test

Moisture-Density relations of soils using a 10# rammer and an 18" drop	AASHO Designation: T 180-57

Unified Soil Classification

Designation E-3 from "Earth Manual" by the United States Department of the Interior Bureau of Reclamation

GENERAL TESTING METHODS

Consolidation Test

Chapter IX
"Soil Testing for Engineers"
by T. William Lambe
The Massachusetts Institute
of Technology

Laboratory Shear Test

Laboratory shear test using the Torvane

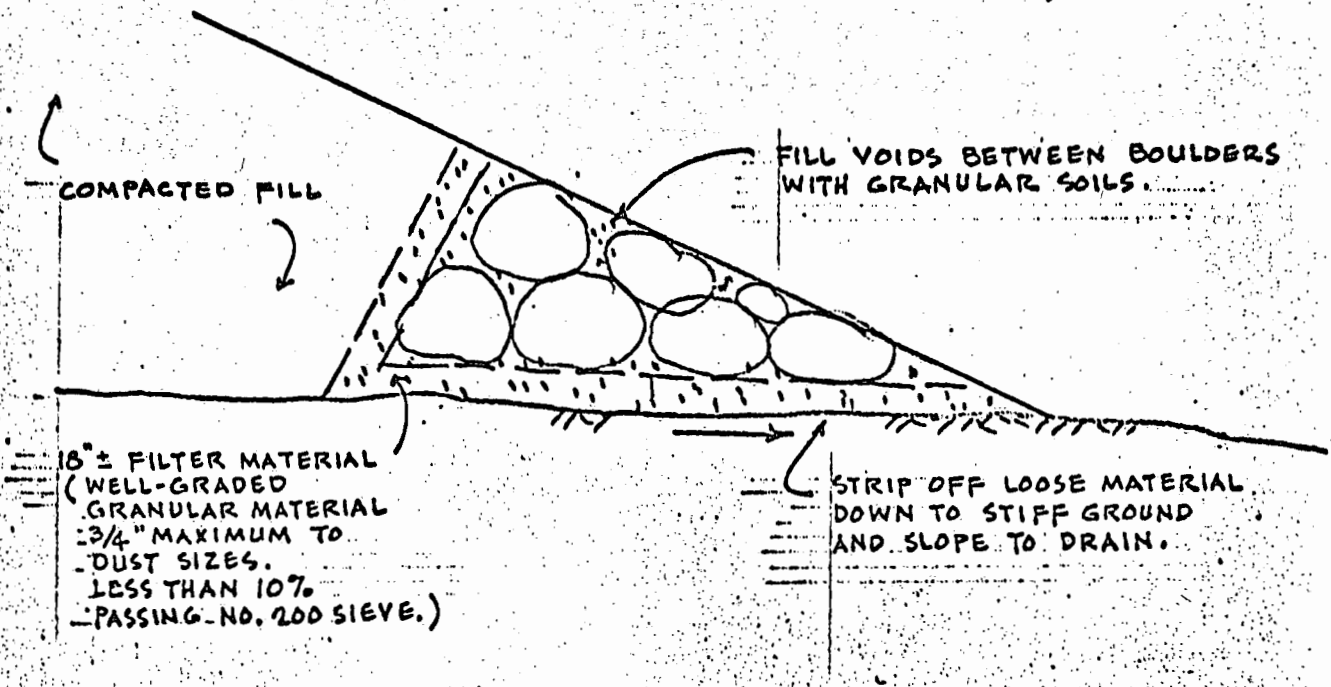
Brochure by Soiltest, Inc.

LIMITATIONS

In general, soil formations are commonly erratic and rarely uniform or regular. The boring logs indicate the approximate subsurface soil conditions encountered only at the drill holes where the borings were made at the times designated on the logs and may not represent conditions at other locations or at other dates. Soil conditions and water levels may change with the passage of time and construction methods or improvements at the site.

During construction, should subsurface conditions much different from those in the borings be observed, encountered, or otherwise indicated, we should be advised immediately to review or reconsider our recommendations in light of the new developments.

Our professional services were performed, findings obtained and recommendations prepared in accordance with generally accepted engineering practices. This warranty is in lieu of all other warranties expressed or implied.



SECTION

NOT TO SCALE

FIGURE 3

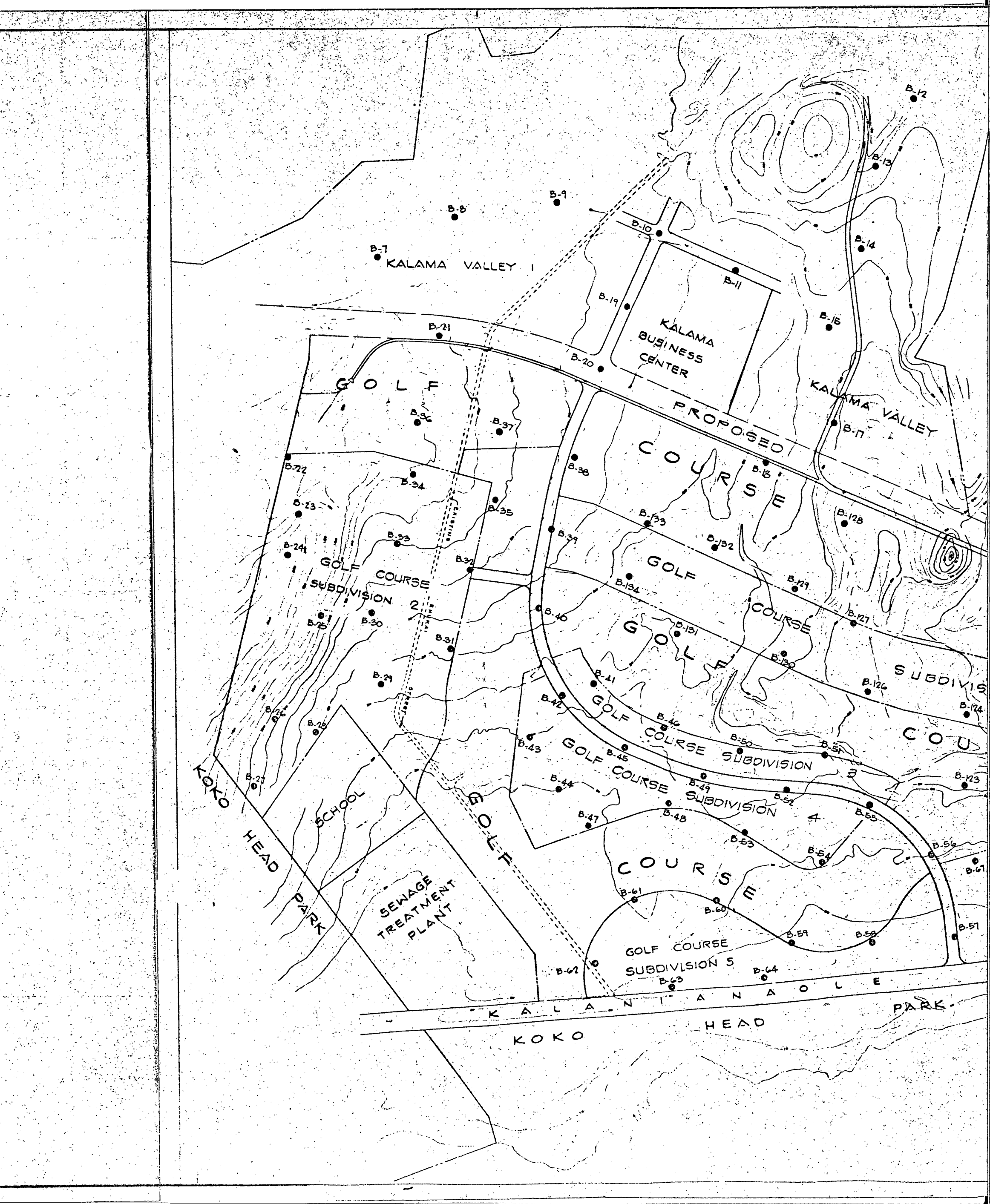
PROPOSED BOULDER FILL

RESORT NO. 2

MAUNALUA, OAHU, HAWAII

TAX MAP KEY: 3-9-11

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS


B-1
B-2
B-3
B-4
B-5
B-6
B-7
KALAMA VALLEY 1
B-8
B-9
B-10
B-11
B-12
B-13
B-14
B-15
B-16
B-17
B-18
B-19
B-20
B-21
KALAMA BUSINESS CENTER
KALAMA VALLEY
PROPOSED
GOLF COURSE
B-22
B-23
B-24
B-25
B-26
B-27
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B-133
B-134
GOLF COURSE SUBDIVISION 2
GOLF COURSE SUBDIVISION 3
GOLF COURSE SUBDIVISION 4
GOLF COURSE SUBDIVISION 5
SCHOOL
SEWAGE TREATMENT PLANT
KOKO HEAD PARK
KALANIANAOLE
KOKO HEAD

TRUE NORTH
SCALE: 1"=400'

COMMERCIAL 2

MATCH LINE

MATCH LINE

HAWAII KAI GOLF COURSE

QUEEN'S RISE

RESORT 4

B-111 B-109 B-104 B-102 B-105 B-108 B-110 B-106 B-107

HIGHWAY

B-112

GOLF COURSE

B-121 B-120 B-113 B-114 B-122 B-119 B-115

SE

B-68 B-118 B-116 B-117 B-69 B-66 B-70 B-73 B-74 B-79 B-78 B-65 B-71 B-75 B-76 B-72 B-77

GOLF COURSE SUBDIVISION

HIGH

RESORT 1

COMMERCIAL

RESORT 2

B-86 B-87 B-88 B-89 B-93 B-85 B-90B B-92 B-90C B-90A B-80 B-84 B-91 B-94 B-81 B-82 B-83

B-95 B-96 B-97

RESORT

PACIFIC OCEAN

FIGURE 1

BORING LOCATION PLAN
RESORT No. 2
MAUNALUA, OAHU, HA
TAX MAP KEY: 3-9-

Dr. ____
Date 8/10
Rev. ____

WALTER LUM ASSO
3039 WAIALAE
CIVIL ENGIN
PHONE 737-7